

WASHINGTON

SCIENCE TRENDS

Vol. II No. 25

A Missile Merger?

Far-reaching implications for science and engineering aspects of the national defense effort stem from a new Congressional report urging merger of the Army and Air Force into a single service to develop, build and deploy ballistic missiles, with the Navy remaining a separate organization for the exploitation of seapower.

House Committee on Government Operations issued its report on organization and management of missile programs at a time when both the Army and Air Force are struggling to retain their missile projects intact under the Fiscal 1961 budget now being drafted. The two services are united, however, in one major aspect of the national space-missile program -- dislike for the Advanced Research Projects Agency which functions as the Defense Department's manager in advanced technology.

The Congressional group believes that the need for ARPA would be eliminated in an Army-Air Force merger. It believes that such a merger would also eliminate enormous overhead in manpower and facilities; would encourage greater cooperation with a diversified missile industry; would eliminate the bitterness, waste and duplication in air defense missions and would end interservice conflicts over airlift, tactical support aviation and other matters.

Although the Army fears, with much justification, that it would be completely subordinated in such a merger by Air Force "glamor" the facts, as outlined by the House Committee, may indicate otherwise.

For example, the Committee points out that the Army, with its developmental arsenals and laboratories has a decided advantage over the Air Force in capabilities; that the Army has more technical capabilities to offer in the operation and deployment of land-based strategic missiles, both now and in future "mobile" weapons systems such as the Minuteman. It is rather ironic, in the Committee's view, that the Air Force achieved its separation from the Army at the threshold of the decline of airpower and of the rise of missile power.

These judgements, however, could be out of date in a matter of months. Many old-line Army officers are restive over the very real neglect of "limited war" capabilities. And it is not at all certain that the considerable Army resources at Huntsville, Alabama, can survive intact by performing odd chores for other organizations.

Report available shortly. 156 pages. Free. (Write Military Operations Subcommittee, U.S. House of Representatives, George Washington Inn, Washington, 25, D.C.)

HIGHLIGHTS

- * A Missile Merger?
- * Maritime Research Plans
- * Metal Research Plans
- * Research Checklist
- * Publications Checklist

Sept. 7, 1959

Maritime Research Plans

Maritime Administration has allocated some \$300,000 for research and development of new navigational aids and safety devices for merchant ships. Items selected require study contracts or development of equipment for evaluation in use.

Programmed items include:

- * Radar Data Computer - to provide automatic evaluation of potential collision situations and give sufficient advance warning to avoid a collision situation.
- * Radar Transponders and Reflectors - Reflectors are expected to provide better detection of radar echoes at extreme range. In addition, easier determination of course and speed of ships being tracked might be aided, it is believed, by further development and adaptation of military electronic equipment now available.
- * Signals - Maritime sees a need for improvements in ship turn indicators and navigation light systems.
- * Ship Signal Detection and Generation System - Requirement exists for more adequate methods for detecting other ships and communicating between ships by electronic means.
- * Momentum Indicator and Auxiliary Maneuvering System - Need for more precise methods for anticipating and controlling movements of a ship through the water is indicated by frequent docking accidents. It is believed that an auxiliary propulsion system such as the vertical axis propeller would make the ship more responsive to helm and engine orders and provide greater flexibility.
- * Radio Navigation System - Maritime believes it may be possible to develop a practical mechanical method for ship navigation using standard AM radio broadcasting stations to provide bearings for a ship at sea.
- * Underwater Sound System - The use of underwater sound to measure water depth, in general use as a navigational aid in coastal waters, is also believed to offer the possibility of providing detection and communication systems less subject to the effects of weather while operating at greater ranges than is possible with airborne sound.
- * Shipboard Oily-Water Separation - Ships must now ballast their fuel oil tanks with salt water to maintain proper stability. Maritime is looking for a practical method of separating oil and other liquids from bilge water and fuel tank ballast so that contamination of coastal waters can be reduced or eliminated.

(Further information on any of these projects, as available, may be obtained by writing to Coordinator of Research, Maritime Administration, Room 3033 GAO Bldg., Washington 25, D.C.)

National Science Foundation

Colleges, universities, nonprofit research and higher educational institutions will be eligible for National Science Foundation financing of programs designed to aid science-minded high school and college students and teachers. Programs now open for proposals cover Summer, 1960 and the 1960-1961 Academic Year, and include:

* Summer Science Training for secondary school students interested in working and studying with experienced scientists and mathematicians in classrooms, laboratories and research facilities. Proposals from organizations interested in NSF support of such programs must be postmarked by October 12, 1959.

* Undergraduate Research and Training Programs under which students participate in established programs at colleges and universities which are financed primarily for objectives other than undergraduate education, as well as new programs designed to provide educational experiences. Colleges and universities interested in such programs for the Summer of 1960 must submit proposals postmarked not later than November 15, 1959; those beginning in the Academic Year 1960-1961, not later than January 8, 1960.

* Research Participation for Teacher Training under which science and mathematics teachers in high schools and instructors in science, engineering and mathematics in colleges receive subsidized research experience and training in college and university laboratory, field or theoretical investigations. These are summer programs only and proposals must be postmarked by midnight October 26, 1959.

* In-Service Institutes provide secondary school teachers of science and mathematics with subsidized after-hours training. Colleges and Universities interested in sponsoring such institutes must submit completed proposals by November 30, 1959.

(Suggestions for preparation of proposals and further information may be obtained from the Special Projects in Science Education Section, Scientific Personnel and Education Division, National Science Foundation, Washington 25, D.C.)

New Inertial Guidance Lab

Air Force will establish a new Central Inertial Guidance Laboratory at the AF Missile Development Center, near Alamogordo, New Mexico at a cost estimated to be about \$34 million. About 350 engineers and scientists will be assigned to the new facility, which is expected to be fully operational by 1963. In addition to the static lab equipment, the Air Force will make use of the 35,000 foot, high-speed captive track, the stratosphere chamber and other existing equipment at the base.

Electronic Conference

Army Ordnance and Office of Naval Research will sponsor a Conference on Electronic Conductivity in Organic Solids at Duke University, April 20-22, 1960. Further information available from Dr. Marvin Silver, OOR, Box CM, Duke Station, Durham, N.C.

Special Report - Metal Research Plans

Here is an up-to-date summary of research plans and programs for the U.S. Bureau of Mines: These programs will be carried out in various Government Laboratories during the coming year:

Copper - Bureau expects to complete and issue a final report on studies involving the extraction of copper from oxide and mixed oxide-sulfide ores by the segregation process. Other projects include studies on the dissolution of copper sulfide minerals at elevated temperatures and pressures: deoxidation of blister copper by such gases as carbon monoxide, hydrogen, methane or their mixtures; electric smelting of copper precipitates to produce a commercially usable metal; the effect of ultrasonic waves of various frequencies and intensities on the electro-deposition of copper; and the extraction of copper from marginal ores by bacterial action.

Rare Earth Metals - Bureau will emphasize research in electrolytic reduction of rare-earth metals, which led recently to experimental production of high-purity cerium. Various solvent-extraction and ion-exchange techniques will be evaluated in an attempt to develop a continuous process for recovery from ores, concentrates and mill residues. New and improved analytical methods are being sought that will permit the detection and measurement of minute quantities of impurities in experimental products.

Columbium and Tantalum - Bureau will begin work this year on the preparation of columbium by thermal decomposition and will expand studies of bomb-reduction fused-salt electrorefining and similar processes. Minerals-beneficiation techniques and new anhydrous methods for separating columbium and tantalum are being tested on a laboratory scale. A continuous demonstration unit will be developed for extracting, separating, purifying and reducing tantalum and columbium from low-grade ores.

Tungsten - Research will be devoted largely to improving methods for refining and evaluating high-purity tungsten, with emphasis on developing precise analytical techniques. Studies will be conducted of a technique for producing alloys of tungsten in which mixed oxides are co-reduced under high pressure in a sealed bomb. Bureau metallurgists will investigate new techniques for melting tungsten and casting it into ingots, and will study the electrolytic reduction of tungsten concentrate to metal powder.

Magnesium - Studies are underway to develop magnesium alloys with three or more components which will have new uses or improved service characteristics. Review and analysis work will center on the damping capacity of commercial magnesium alloys and new alloys in various semifabricated form. Production processes will be evaluated to determine the course of future research in developing improved production techniques.

Abrasives - Substitutes for industrial diamonds and corundum which must be imported at present will be sought by Bureau researchers. Work includes production of zirconium boride directly from the mineral zircon and a boron compound and studies of the commercial use of zirconium boride compacts. The use of ultrafine nickel and cobalt powders as binders in synthesized hard materials will also be investigated.

Beryllium - Bureau expects to build and operate a small plant for the experimental recovery of low-grade beryl ore by flotation. Concentrates obtained from ore-dressing studies will be reduced to salts and then to metal. Emphasis will be placed on a nationwide search for beryllium ore.

Nickel-Cobalt - At the Bureau's Salt Lake City Metallurgy Research Center work will go forward on potential methods for production of high-purity nickel and cobalt from laterite and serpentine ores. Greatest attention will be devoted to the use of a solvent extraction process. At the Rolla, Mo., Metallurgy Research Center, studies will include methods for preparing super-pure nickel and cobalt and determination of physical and mechanical properties. The alloy character of high-purity cobalt will also be studied.

Cesium-Rhenium-Rubidium - Bureau hopes to complete its investigation of domestic sources and plans to begin research to develop a simple field test for these elements. At the same time, complementary mineral-dressing, extraction, separation and reduction studies will be carried forward to develop practical methods for recovering high-purity cesium and rubidium salts and metals.

Zirconium and Hafnium - Studies in the forming of zirconium with explosives will be inaugurated this year as well as research on fabrication techniques such as deep-drawing and extrusion. Direct chlorination of zircon is being investigated as a possible means of simplifying the process by which crude zirconium tetrachloride is formed. Attempts will be made to determine the effect of gamma-irradiation on zirconium and hafnium compounds as a possible means of simplifying separation.

Chromium - Studies will emphasize chemical treatment, electric-furnace smelting and flotation techniques. Limited work will be carried out on the recovery of chromium from laterites and serpentines by hydro - and pyrometallurgical methods. As the only source for high-purity ductile chromium wire, the Bureau will prepare small quantities for use in cancer research and other special studies.

Bauxite and Aluminum - Bureau will analyze and evaluate several processes for the recovery of alumina from nonbauxitic raw materials. Results will be published this year as a comprehensive report which will include balanced flowsheets and estimates of heat balances, costs and capital investments. Basic studies will continue on the electrolytic reduction of alumina to improve cell efficiency as well as the recovery of alumina from crude aluminum-silicon alloys.

Steel - Bureau will attempt to develop a test for evaluating the hot-working characteristics of steel, in an effort to lower alloy requirements. A scrap pre-heater will be used in a study of methods for removing contaminants from iron and steel scrap. An experimental blast furnace will be used to investigate the injection of coal, gas and liquid fuels in place of coke. Other studies will include factors affecting uniformity of steel and the function of rare earths in steel. Research will go forward on methods for making sponge iron and steel directly from iron ore and on the effects of titania on the characteristics of conventional slags used in smelting and refining various iron ores.

Research Checklist

() Plastic Testing Device - Navy is using a new pendulum-type device to test the impact and shock-resistance of plastics and to investigate any existing relationships of plastic materials between impact resistance and the rate of loading. Tests have shown that the device is stable in operation, can be operated without special training and can be maintained with standard machine shop tools. A trigger bomb release actuates the pendulum arm which contains anvils capable of delivering sharp impact blows.

(R&D by Bureau of Ships, U.S. Navy and Department of Engineering Research, North Carolina State College, Raleigh, N.C.)

() Crash Fire Protection System - NASA researchers have designed a crash fire protection system which is reported capable of suppressing the ignition of crash-spilled fuel that may be ingested by a T-56 turbojet engine. Combustion chamber flames were rapidly extinguished during tests and hot engine parts were inerted and cooled by water discharged at various engine stations.

(Report available. Single copies free. Write Technical Information - BID, NASA, 1520 H Street, N.W., Washington 25, D.C. for Technical Note D-28)

() Aircraft Canopy Development - Research by Goodyear Aircraft is said to have resulted in development of a transparent canopy for protection of pilots flying at speeds approaching Mach 3 or 1950 mph. A new interlayer material formed of a fluid resin reported to be easily castable was used. The material is cured below 220 degrees F. to a tough, flexible state with high temperature resistance and distortion-free optical characteristics.

() Dielectric Liquids - Navy researchers have found that it is possible to use molecular structure as an effective guide to the synthesis of practical liquids of high dielectric constants. Up to the present, five fluoresters having dielectric constants of eight or above have been synthesized. The research is directed toward development of liquid impregnants for paper and plastic-film capacitors having a wide temperature range.

(Further details in NRL Report 5350 to be published in the near future by the U.S. Naval Research Laboratory, Washington 25, D.C.)

() Vapor Lock Research - The Southwest Research Institute, in a study sponsored by the U.S. Army has investigated gasoline vapor-locking tendencies in civilian and military vehicles in the light of larger engines, lower hoods, higher octane gasolines and other recent developments. The studies showed a variety of opinions on causes and possible cures.

(Report available. 63 pages. \$1.75. Write OTS, U.S. Department of Commerce, Washington 25, D.C. for PB 151 437)

() Waterproofing Strain Gages: A new technique developed by the Navy is said to provide complete waterproofing of strain gages placed on the exposed underwater hull surfaces of ships. Wax, self-vulcanizing rubber and a stainless steel shim cap are used. The development is said to have made possible a number of test programs that could not otherwise have been carried out. Materials and techniques are said to be applicable to numerous other projects.

(R&D by Instrumentation Laboratory, David W. Taylor Model Basin, U.S. Navy, Carderock, Md.)

() Ball-Bearing Lubrication: Studies by the National Bureau of Standards indicate that polyester felt pads saturated with special oils may be used with pre-lubricated ball bearings in aircraft accessory equipment such as gyros, motors and inverters. The material bleeds the oil slowly to the races of the ball-bearings in extreme temperature environments where conventional lubrication systems may fail.

(Further details available from Paper 63Cl-2. Write National Bureau of Standards, Office of Technical Information, Washington 25, D.C.)

Novel Engineering Program

Army Ordnance has now expanded its program of support for preliminary investigations of promising novel ideas in the area of Ordnance engineering. Funding for each project has been increased from a maximum of \$1,000 to \$8,000. While emphasis is still on work in Army laboratories, small contracts are now being arranged for work by universities. In the past six months five proposals have been approved at universities for a total of \$21,000.

Typical "N" Project studies:

- * "Muscle Engine" - Ordnance is interested in any means of converting chemical energy into mechanical energy directly, without going through a heat cycle. According to the Office of Ordnance Research an investigation at Frankford Arsenal has proved so successful a full-fledged project is now underway on the subject "Synthesis of Polyelectrolytes for Contractile Films" dealing with the magnitude and response time of expansion and contraction of such films.
- * Anodic Spark - This project is on "Anodic Spark Preparation of Cadmium Niobate" and is designed to determine how the electrical properties of cadmium niobate are affected by its preparation in the anodic spark reaction. It is believed that such material may have unique and valuable electrical properties which may make it useful for capacitors and electro-mechanical devices.

Other projects in the "N" program include tests to determine whether laminar flow can be stabilized by high-frequency vibration as a means of improving performance of large liquid fuel missiles and exploratory development of an aerial camera designed to make possible improved precision measurements of the position and orientation of a test vehicle in space.

PUBLICATION CHECKLIST

- () Space Propulsion, a Congressional report on present-day and future developments in the field of space propulsion systems, with some conclusions about progress and potentials. 15 pages. Free. (Write Committee on Science and Astronautics, New House Office Bldg., Washington 4, D.C. for Report No. 26)
- () Soviet Moon Rocket, Was Mechta an elaborate Russian hoax? A Congressional jury thinks not. Thirty-two pages, with additional background on Soviet space experiments. Single copies free. (Write Committee on Science and Astronautics, New House Office Building, Washington 25, D.C. for Report No. 33)
- () Oceanography, two additional chapters are now available in the continuing report of a Committee on Oceanography. Chapter 6, 20 pages, surveys research ship needs. Chapter 10, 8 pages, covers international cooperation. Single copies free. (Write Information Office, National Academy of Sciences, 2101 Constitution Avenue, Washington 25, D.C.)
- () Nuclear Power Costs, an AEC staff study on the economic aspects of atomic power. Covers capital costs, fixed charges, and similar information on reactors existing, being built, or planned for early construction in the U.S. and abroad. Twenty-nine pages, 50 cents. (Write OTS, U.S. Department of Commerce, Washington 25, D.C. for TID - 8506)
- () Nuclear Fallout, a summary-analysis of Congressional hearings on the problems of fallout from nuclear weapons tests. A valuable reference guide. Forty-two pages. Single copies free. (Write Joint Committee on Atomic Energy, F-88, The Capitol, Washington 25, D.C. for Summary-Fallout)
- () Patent Practices, the latest in a series of Congressional studies of Patent Practices of various Government agencies. This one covers devices developed under research sponsored by the Veterans' Administration and raises a number of policy questions. Sixteen pages. Single copies free. (Write Subcommittee on Patents, Senate Judiciary Committee, Senate Office Building, Washington 25, D.C. for VA Patent Practices)
- () Solar Sailing, a Los Alamos plan which envisions the use of photon propulsion for visits to the planets. Eighteen pages. 75 cents. (Write OTS, U.S. Department of Commerce, Washington 25, D.C. for SCR-78 - Solar Sailing)
- () Nuclear Reactors, an AEC summary of Nuclear Reactors built, building or planned in the U.S. as of June 30, 1959. Thirty-two pages. Single copies free. (Write Technical Inf. Service Extension, U.S. AEC, P.O. Box 62, Oak Ridge, Tenn.)
- () Transistors, a 1959 revision of a catalog listing Army, Navy and Air Force research reports on transistors. All reports are available for purchase. Catalog free. (Write OTS, U.S. Department of Commerce, Washington 25, D.C. for CTR-310)

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